In conclusion, we wish again to state that in our hands the agglutination test has not proved itself of value to control tuberculin administration when given to cases with pulmonary tuberculosis. We consider that the only reliable means which we have at present to govern such cases is to observe them carefully after each dose of tuberculin, and to be acquainted with even the slightest signs of reaction; in other words, that the clinical method is at present the most reliable method to govern us when giving tuberculin treatment to cases of pulmonary tuberculosis. We have had no experience in the use of the agglutination or opsonic method in surgical tuberculosis, although the latter appears of value according to some workers, referring to Wright's school.

THE VALUE OF RÖNTGEN-RAY EXAMINATION IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS, ESPECIALLY IN REFERENCE TO EARLY TUBERCULOSIS.[1]

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Almost all recognized radiologists have expressed themselves concerning the value of Röntgen-ray examinations in the recognition of early pulmonary tuberculosis. In addition to Professor Rieder, I may name Albers-Schönberg, A. Köhler, Holzknecht, Immelmann, Levy-Dorn, Bade, Hildebrandt, Gocht, Schellenberg, and Grunmach; in America, Williams and Walsham; and in France, Beclere. Even today opinions as to the value of the method are by no means clear. Advance, of late, however, is to be noted, inasmuch as the enthusiasts, whom we heard in the early days of the Röntgen era, have been silenced, and among the fewer well-informed the belief has been awakened that it is only necessary to take the fluoroscopic screen in hand to detect at the apex of the lung the smallest tuberculous change. Today the majority of physicians are opposed to *x*-ray examinations in early tuberculosis, but according to my belief unjustly so. This comes in largest part because, from the first, more has been expected of *x*-ray diagnosis, than a priori is possible for it to give. It cannot and never can lead to an absolutely certain diagnosis, when even with all clinical and bacteriological methods of examination such diagnosis is impossible. I believe, further, that this never will be possible, notwithstanding all anticipated improvements in the technique. Anything different is not to be expected. How often it is our experience that other methods, for example, the chemical, bacteriological, and even the anatomical, are not in a position to give a clear interpretation of pathological relations. Even with these methods frequently the conclusion is *non liquet.*

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[1] Read at the International Congress on Tuberculosis, Washington, D. C., September–October, 1908.

I purpose here not to review critically the opinions of all observers as I glean them from their contributions and, in part, from their expressions of opinion, but to state, with due regard to the results of the investigations of other authors, my own observations as to the manner and extent in which the *x*-rays have served me in the diagnosis of early tuberculosis. These conclusions are based on my extended experience in the medical clinic at Breslau and in the medical polyclinic at Jena.

I. First a few words about the technique of *x*-ray examinations in pulmonary disease: Among a large clientele, especially if it is composed of ambulatory patients, the fluoroscope is preferable. *X*-ray photography costs too much in time and money, and is, on that account, to be reserved exclusively for special cases. If the fluoroscopic screen is to be employed in a correct, profitable way, the following points must be considered:

1. The examining room must be darkened in the most complete way possible. An examination in a room in which, from unexcluded daylight, all objects may be recognized is thoroughly inadequate, and to my mind impossible. In spite of this, I saw within the last year, in an *x*-ray laboratory, that this factor important to a successful examination was not entirely fulfilled.

2. The *x*-ray tube must be placed in an absolutely light-tight box so that the fluorescent light of the *x*-rays is completely masked. The usual method formerly employed of excluding the rays by means of a dark cloth proved entirely inadequate. Covering the *x*-rays with a pasteboard box or a screen is likewise insufficient. If delicate distinctions are to be detected in the fluorescent light of the Röntgen screen, it is absolutely requisite that no other disturbing light phenomena shall encroach. The room must always remain absolutely dark during the use of delicate tubes.

3. The fluoroscopic box must be provided with a lead covering to protect the patient and the operator against the baneful influence of the *x*-rays.

4. The box must be so hung as to be easily movable, in order that the tube may be manipulated without difficulty.

5. The arrangement of diaphragms must be as good as possible. My experience is that the slit diaphragm is to be preferred to the round diaphragm for fluoroscopic examinations of the apices.

It is obvious that to obtain satisfactory results a good, luminous barium-platinum-cyanide screen is necessary. Likewise the eye of the operator must be rested, so as to be completely adapted to darkness. In this last respect all of us have frequently failed, when amidst the rush of a large clinic or dispensary there was not time enough to wait for this. When the result of an examination is doubtful, the time must be found. Upon coming from daylight, which is bright or even dull, at least three to five minutes should be spent in the dark room, in order to rest the retina before proceeding with the examination. Through this slight delay the ability to detect delicate differences on the screen will be materially increased.

If the Röntgen photograph is to be employed, it is well to use for this purpose the diaphragm plates of Albers-Schönberg, if possible, in the dorsoventral and ventrodorsal diameters. Recently I used with advantage the examining chair devised by Albers-Schönberg for this work. First of all, with the slit diaphragm, the apices of the lungs are brought into the best possible focus with the patient in a sitting position. Following fixation the plate is inserted and an exposure of fifteen to twenty seconds is made with the full strength of the tube. The round diaphragm also gave good results.

II. Since in early adult pulmonary tuberculosis we expect differences in the transparency of the apices, it is both desirable and valuable to learn whether in persons, in whom beyond question there is no difference to be found at the apices by means of percussion and ascultation, there exist differences in regard to the transparency and expansion of the apices of the lungs. In order to answer this question I have looked over 80 previously collected cases of my own, in addition to about 180 suitable cases from our wealth of clinical material (we had 5880 patients in the Medical Polyclinic at Jena during the past year) which, along with Dr. Friedrich, I have examined with especial reference to this. In this conjunction I will briefly mention that undoubtedly conditions exist which make the normal lung apex appear dark with the fluoroscope. Among these conditions are the following: (1) Changes in the skin (scleroderma and edema of the skin). (2) Marked increase of the subcutaneous fat (general obesity, lipoma formation). (3) Enlarged, caseous, indurated, calcified lymph glands, which lie in the supraclavicular fossa or in the superficial or deep cervical region. (4) Remarkably good musculature. This is more marked especially on the right side than on the left; on this account noticeable röntgenoscopic differences occur. (5) Aside from the four above noted points, now and again darkening of the apices is seen because of the blending of the shadows of the clavicle and first ribs, or because the apices are unusually deeply placed. If these observations are taken into consideration, in order to avoid errors, one should carefully inspect and palpate before giving an opinion as to the results of x-ray findings, or even before making an examination; usually also before the fluoroscopic examination.

From my own experience there also occur in doubtful pulmonary cases, in which the above sources of error have been excluded, slight variations in the transparency of the lung apices. They are, indeed, only slight, but in the future will cause me to control regularly the fluoroscopic examinations of doubtful cases by means of the *x*-ray picture. As regards the expansion and height of the apices, in unproved pulmonary cases slight differences are also noted by the *x*-ray examination. In a series of observations carried out under the direction of Professor Gerhardt at the Medical Polyclinic in Jena, Dr. Seufferheld obtained from examination of the apices by physical examination results that were to be expected, that is, slight differences in the percussion note and variations in the breath sounds. Further, Kronings, in some interesting examinations, discovered that there exists congenital, but little understood, malformations of the apices (heteromorphia and heterotopia). These also can cause röntgenoscopic variations.

III. What can we accomplish, with attention to the enumerated points, by means of *x*-ray examinations in early tuberculosis?

A. Early Tuberculosis in the Adult. In adults we look for and find, with ordinary clinical methods of examination, for the most part, a lesion at the apex; in early cases frequently only a catarrh, in further advanced cases infiltration processes. In a large number of these there are only uncertain findings—differences of pitch, uncertain roughened breathing, and prolonged expiration. If infiltrations are present, the air-containing tissue is replaced by airless or rather air-poor tissue. In such cases we see, provided the infiltration has progressed sufficiently, instead of transparency, a deep or moderately deep shadow, according to the extent of the lesion. If the infiltration extends to or into the neighborhood of the surface of the apex, we may recognize it by percussion, auscultation, and röntgenography. If it exists in the centre of the apex, without approaching the surface, or if isolated, unusually large confluent emphysematous bubbles have formed above the infiltration process (as I found explained by autopsy in a particular case), the infiltration is not recognizable by percussion. On the other hand, such lesions are seen excellently with the fluoroscope and *x*-ray pictures. I dispose of those examination findings which confirm or supplement our clinical findings in an unexpected way. In addition, in many cases in which we have positive dulness and in which a decided shadow is to be expected, our clinical findings are proved, inasmuch as the extent of the infiltration is shown to be greater than was expected.

I have convinced myself, by the method of Albers-Schönberg, that infiltrations exist, which, even with good diaphragming, can either not be recognized or only very uncertainly recognized by means of the fluoroscope. On the other hand, they give absolutely certain findings on the plate, especially with diaphragm pictures.

Thereto in part belong those cases in which we have uncertain percussion findings, merely slight catarrh, or only doubtful percussion and respiratory signs. Under these conditions, we obtain differences in the fluoroscopic picture of the apices, just as we did in unrecognizable pulmonary disease. In such patients the photograph asserts its importance and is indispensable.

In patients who give apical findings suspicious of tuberculosis, without having frank auscultatory or percussion signs, we repeatedly see well-marked darkened apices, which do not clear up upon repeated deep inspirations. Besides, in these patients the photographic plate repeatedly shows not only a reduced air-content, recognizable by a cloud-like shadow, but also a circumscribed shadow, seen over deep-seated infiltrations. When both apices are equally or only slightly darkened, I have grown cautious with the röntgenoscopic diagnosis, because I have often found that by means of systematic weekly or bi-weekly breathing exercises the apices have cleared up very considerably.

In regard to the height of the apices, no significance can be attached to slight differences. If there exists a difference of 1 to 2 cm., especially if associated with alterations in the transparency, the presence of contraction may be inferred. I have also taken up röntgenographically the width of the apices, in sagittal section. Krönig has taught widely throughout medical circles the importance of determining this by means of percussion. Some time ago Freund again pointed out the importance of ossification of the first costal cartilage in the beginning of pulmonary tuberculosis. This led to proof of the early ossification of the costal cartilages by means of the x-rays. Immelmann and F. M. Grödel have paid especial attention to this and have reported suggestive results. It is, however, advisable that further studies be undertaken along this line.

A certain importance seems to have been attached to a symptom described some years since by Williams, that is, the lagging of the movements of the diaphragm on the affected side, even in the early stage of incipient tuberculosis. Statements to the contrary notwithstanding, I personally cannot attach any diagnostic importance to this symptom. I have failed to find it in somewhat over half the cases. With the object in view of proving this, I intend to make measurements of the extent of the excursion of the diaphragm movements. It seems to me that at present, Williams' phenomenon cannot find application as an aid to the early diagnosis of tuberculosis of the lungs.

If we ask the question, whether the signs elicited by the x-rays permit of a positive diagnosis, or whether the changes that are observed can be interpreted as especially tuberculous, or whether they can also occur in diseases of other genesis, as from the inhalation of dust or anthracosis, we can only give a provisional answer. To my mind these processes have nothing specific about them; we cannot see with the x-rays tuberculous processes in the strict sense; we see only the condensation of tissue caused by the tubercle bacilli. The fact is, that we need clinical methods in order to determine the diagnosis of tuberculosis; the x-ray findings do not suffice. Furthermore, whether the change which exists is active or passive cannot be determined. Therefore, I practise fluoroscopy as a method which is to be regarded somewhat the same as bacteriological methods are regarded in relation to percussion and auscultation; but like them it is not enough alone to determine the clinical diagnosis of tuberculosis.

B. Early Tuberculosis in Children and Young People. In many cases we find the apices of the lungs free from disease. Above all, we further know, through the anatomical findings, that pulmonary tuberculosis of children and young people begins in the glands at the hilum of the lungs. Frequently clinical examinations fail or give ambiguous results. By means of the fluoroscope (good diaphragming is always essential) or the x-ray photograph, changes in the hilum shadows can be shown positively (that is, shadows of enlarged calcified glands) which are not revealed by any other method.

I now desire to call attention to a type of early pulmonary tuberculosis which occurs in youth. We frequently see a disease characterized by all the symptoms of a central pneumonia—high fever, rapid pulse, rusty sputum, and pneumococcic bacteremia. Through the aid of the fluoroscope we can demonstrate a more or less extensive, deep shadow. After a number of days, about five to nine the fever disappears, but by the fluoroscope and photographs it can be noticed that the shadow has not become more transparent. In fact, in the course of the succeeding week, extension occurs, frequently first seen as string-like shadows tending toward the periphery. In my cases the subsequent gradual recurrence of fever and finally the presence of tubercle bacilli in the sputum proved that, as a matter of fact, the condition was tuberculous. This clinical course seems not uncommon in younger people.

For the recognition of tuberculosis of the bronchial glands examination by the x-rays is absolutely indispensable.

Conclusions. *A. What x-ray examination furnishes in early tuberculosis of the adult.*

1. Infiltration processes at the apex, recognizable by percussion, which have a known extent, give a more or less deep shadow with the fluoroscope. The x-ray examination is frequently superior, as compared to the clinical, since it demonstrates that in many cases the process is more extensive than would be expected.

2. Infiltrations, either not demonstrable by percussion or only uncertainly so, can frequently be demonstrated by means of the fluoroscope; or when fluoroscopic results are doubtful, certainly by x-ray photography, diaphragm pictures. Besides, by this method it will not infrequently be shown that we are dealing with a more advanced case than was suspected.

3. The early stages of pure catarrhal processes are recognizable

neither by fluoroscopy nor by röntgenography. In long standing catarrh the results of poor aëration are seen with the fluoroscope as darker apices which do not clear up on inspiration. In important cases photography, in the shape of diaphragm pictures of the apices, should at once be employed. Beginning infiltrations are frequently recognized by this method which are not recognizable by any other.

4. The height of the apices, in doubtful cases determined by orthodiagraphic measurements, is only of importance when differences of 1 to 1.5 cm. exist. The width of the apices of the lungs has not yet been sufficiently studied röntgenographically to find employment diagnostically. Calcification of the first rib is well shown by diaphragm pictures, and according to Freund can be used as an aid in the diagnosis of incipient tuberculosis. The clearing of the apices with respiration, which is present in health, is frequently lacking on one or both sides in early tuberculosis. Movement of the diaphragm is altered in many ways; a unilateral lagging of the diaphragm on the affected side (Williams' phenomenon) cannot be classed as a special symptom, and, therefore, diagnostically is of no value. Orthodiagraphic measurements are needed. From a diagnostic standpoint the existence of rib shadows in x-ray pictures is either not to be taken into account at all, or if so, only with caution.

B. What x-ray examinations furnish in early tuberculosis of children and young people. In most cases apical findings are wanting; hence the recognition of shadow variations at the hilum are all the more important. These variations are due to bronchial glands enlarged as the result of induration, caseation, and calcification, and infiltration processes in the neighborhood of the hilum and bronchi. Frequently the picture of a central pneumonia following pneumococcic infections is seen in these conditions; then without fever the process, röntgenoscopically at least, slowly adadvances, and after weeks is recognized as tuberculous, both by percussion, auscultation, and bacteriologically.

Furthermore, in well advanced pulmonary tuberculosis x-ray methods of diagnosis furnish very well, frequently surprisingly well, a supplementary picture to the clinical findings, both with the fluoroscope and with x-ray photography. By this method we often see that which we know by autopsy findings, namely, that the tuberculous process is considerably further advanced than we supposed from our clinical examination. If, as so frequently happens, an extensive peribronchial infiltration exists about the main bronchi of the lower lobe, a very characteristic picture is obtained with the fluoroscope. In addition, by means of x-ray diagnosis those infiltration foci which develop from the bronchial glands—clinically they often begin with the picture of a central pneumonia—are found and discovered with certainty. Moreover, they may be recognized positively as tuberculous if they are a direct continuation of the bronchial gland shadows, especially in the adolescent.

As a valuable addition to our methods of diagnosis, it is noteworthy that it is possible by means of the *x*-rays to recognize positively tuberculosis of the bronchial glands, which formerly we guessed at from the interpretation of the clinical picture. Calcified or chalky foci or glands are seen with remarkable clearness as well at the hilum as within the lung; frequently they are as sharply defined as foreign bodies. The recognition of indurated and swollen glands offers more difficulty. The first give a sharp picture with good diaphragming; their recognition requires practice above everything else. Medullary swelling or caseation of glands are only to be differentiated from lung tissue if the glands occur in large masses which project into the lighter lung tissue. I must emphasize, as an absolute necessity, in the *x*-ray diagnosis of bronchial gland tuberculosis, careful clinical observation with the aid of all known methods, the tuberculin reaction, etc. To be sure, the Röntgen picture will show an atypical or pathological condition at the hilum or in the pulmonary glands; but whether it is an active or passive process can only be determined through clinical observations.

We can diagnosticate cavities with great certainty with photographs, but, as a matter of fact, rarely with the fluoroscope. Those cavities can also be recognized which because of their deep position, are otherwise not amenable to diagnosis. That form of tuberculosis which first appears with the clinical picture of caseous pneumonia—dulness of lobar distribution, and loud bronchial breathing, often for a long time without catarrrh—gives a less intense shadow than croupous pneumonia. As a matter of fact, I have only been able to confirm this by autopsy in two cases.

THE TREATMENT OF TINEA TONSURANS.

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Few cutaneous diseases are more obstinate and stubborn to successfully combat than ringworm of the scalp. Because of the anatomical peculiarities in this locality, as well as the character of the usual infecting organism, it is much more difficult to bring about a cure here than in the bearded region. In the majority of instances (about 90 per cent.) Trichophyton microsporon (Audouini) is the hyphomycete which attacks the scalp. First becoming lodged in the stratum corneum, it multiplies there, giving rise to scaling and slight vesiculation. The growth then extends into the hair follicle and down the sides of that cavity, forming a sort of mosiac basket work encircling the bulb. Beneath this collar the cuticle becomes frayed and broken, probably as the result of the action of a kerato-